APPENDIX N: INFMS DESIRED FUTURE CONDITION MATRIX

The INFMS team looked at past and current conditions, using published research and other data sources.

The team developed a list of issues related to fire and fuels management, based on public opinion, published research and team members personal experience. The team then broke those issues down into component parts and assessed past and present condition of those components, by fire regime. We then asked how we could address those issues in such a way as to move the various issue components toward a future condition which was desirable from the point of view of forest owners (the public) forest workers and forest managers.

Issue 1: Landscape Pattern and Vegetative Diversity

	Past	Present	Desired Future Condition
Fire Regime = ***Low Severity/ High Frequency***			
Stand Structure	Prairie, oak savanna, and oak woodland and open Douglas-fir stands are common.	• Most lands converted to agriculture and urban uses. • Increased canopy closure. • Increased population of shade tolerant species, (Douglas-fir) and exotics (*Cytisus*, *Rubus*, etc.).	Prairie communities, oak woodland, oak savanna and oak forests are present on BLM lands.
Species and age class	• Oak is abundant. • Ponderosa pine is present. • A variety of age classes represented.	Douglas-fir in dense even age stands is ubiquitous.	• Oak is established and maintained on appropriate BLM sites. • Ponderosa pine and Douglas-fir is maintained where appropriate. • Oak and pine represented by several age classes.

	Past	Present	Desired Future Condition
Fire Regime = ***Low Severity/ High Frequency*** *(continued)*			
Patch size	Numerous large patches of prairie, savanna and woodland with considerable fine scale variability.	• Increased fragmentation due to patch clearcutting, roads. • More homogenous at fine scale due to removal of large oak and pine. • Establishment of plantations.	Increased within-strand heterogeneity.
Openings	Prairie, savanna and woodland are abundant .	Prairie, savanna and woodland reduced dramatically due to encroachment of shade tolerant trees and shrubs, agriculture, and development.	Prairie, savanna and woodland are maintained/established where appropriate on BLM lands.
Distribution of age classes (seral stages)	• A mix of ages for individual trees and patches of trees. • Very old individual trees, but few undisturbed stands. • Oak stands are often single layer, late successional stands.	Conversion to early and middle aged Douglas-fir and removal of older oaks, pines.	Maintain a variety of age classes where appropriate.
Dead wood	• Snags uncommon due to frequent fires. • Coarse woody debris minimal, except along waterways.	• Snags uncommon due to development. • Coarse woody debris minimal.	Snags and coarse woody debris uncommon where fire has been reintroduced, except along waterways.
Fire Regime = ***Variable Severity/ High Frequency***			
Stand Structure	Open stands of mixed conifer with even aged patches.	• Increased canopy closure. • Increased population of shade tolerant species. • Increased fuel load. • Increased fuel ladder.	Canopy gaps are a feature of most stands. Basal area and canopy closure is reduced; fuel ladder, fuel continuity, total load of available fuel is reduced.

	Past	Present	Desired Future Condition
Fire Regime = ***Variable Severity/ High Frequency*** *(continued)*			
Species and age class	• Oak, madrone, ponderosa pine, sugar pine, Douglas-fir, incense cedar, etc. species are abundant. • A variety of age classes represented.	• Plantations with dense even age stands of one or two tree species common. • Shade tolerant species increasing.	• Ponderosa pine, sugar pine, madrone and oak are relatively common in all age classes. • Large older trees are common.
Patch size	Numerous large patches with considerable fine scale variability.	• Increased fragmentation due to patch clearcutting, roads. • Increased homogeneity at fine scale due to plantations.	Considerable variability at the fine scale (stand) level.
Openings	• Meadows and forest canopy gaps common on very wet, very dry or rocky sites. • Some meadows may be created or maintained by fire.	• Meadows reduced in size. • Canopy gaps within stands less frequent. • Edges are …	• Meadows and openings are maintained by use of fire where biologically appropriate. • Hardwoods, shrubs and herbs common at forest edges.
Distribution of age classes (seral stages)	Large acreage of older stands due to thinning/fuel reduction effect of low intensity fires.	• Decrease in older stands due to timber harvest. • Potential increase in stand replacing fires.	Increase the acreage supporting older trees. Increase opportunities for reproduction of pine in openings created by fire.
Dead wood	• Small patches and individual snags abundant. • Snags occasionally in large patches. • Coarse woody debris variable, but relatively common.	Snags primarily in small patches and individuals.	Snags are recruited into stands by low intensity fire.

	Past	Present	Desired Future Condition
Fire Regime = ***Variable Severity/ Moderate Frequency***			
Stand Structure	• Stands of very old trees are common. • Multiple canopy layers common. • Shade tolerant trees abundant. • Gaps are common.	• Little change in older stands. • Large areas converted to patches of young even aged stands.	Landscape is a mo saic of multiple canopy layers and densities.
Species and age class	• Douglas-fir, western hemlock and red cedar are common. • Older stands comprise over half of the landscape. • Younger stands dominated by Douglas-fir at varying densities.	• Douglas-fir plantations comprised of dense even age stands of one or two tree species are common.	Multiple species and age classes are present in young and middle aged stands.
Patch size	Numerous large patches, sometimes with fine scale variability where intermediate disturbance has taken place.	• Increased fragmentation due to patch clearcutting, roads. • More homogenous at fine scale due to plantations.	• Patch size increases as plantations reach middle age. • Blend with older stands and as timber harvest is reduced.
Distribution of age classes (seral stages)	Large acreage of older stands.	Decrease in older stands.	• Increase in older stands as young stands age, and stand density is manipulated. • Strategic fuels reduction in young stands to protect adjacent values.
Dead wood	• Snags in large patches, after fires. • Small patches and individual snags abundant in middle and older stands. • Coarse woody debris abundant.	• Snags much less common and generally smaller. • Snags primarily in small patches and individuals.	Large snags and coarse woody debris increasing in abundance.
Stand Structure	• Stands of very old trees common. • Multiple canopy layers common. • High canopy closure. • Shade tolerant trees abundant.	• Little change in older stands. • Large areas converted to patches of young even aged stands.	Landscape is a mosaic of canopy conditions and stand densities.

	Past	Present	Desired Future Condition
Fire Regime = ***Variable Severity, Low Frequency***			
Species and age class	• Douglas-fir, western hemlock, silver fir and red cedar are common. • Older stands comprise over half of the landscape. • Younger stands dominated by Douglas-fir at varying densities.	• Douglas-fir plantations comprised of dense even age stands of one or two tree species are common. • Old stands less common.	Multiple species and age classes are present.
Patch size	Numerous large patches, sometimes with fine scale variability where intermediate disturbance has taken place.	• Increased fragmentation due to patch clearcutting, roads. • More homogenous at fine scale due to plantations.	• Patch size increases as young stands reach middle age. • Blend with older stands. • Connectivity of older stands increases.
Openings	• Meadows on wet or dry, rocky sites. • Some meadows may be created or maintained by natural fire.	Openings common: roads, new clearcut units.	• Openings created and maintained by natural events. • Prescribed fire used where biologically appropriate.
Distribution of age classes (seral stages)	Large acreage of older stands.	Decrease in older stands.	
Dead wood	• Snags in large patches, post fire. • Small patches and individual snags abundant in middle aged and older stands. • Coarse woody debris abundant.	• Snags much less common. • Snags primarily in small patches and individuals.	Snags and coarse woody debris are abundant.

	Past	Present	Desired Future Condition
Fire Regime = ***High Severity, Low Frequency***			
Stand Structure	• High canopy closure. • Shade tolerant trees abundant.	• Little change in older stands. • Small areas converted to patches of young even aged stands.	• Stands generally have high canopy closure. • Shade tolerant trees are abundant.
Species and age class	• Mountain hemlock, silver fir and a variety of other conifers. • Stands of old trees common.	• Little change in species composition. • Stand age is increasing.	• Stands of old trees are common. • Some patches of younger stands are present.
Patch size	Numerous large patches, sometimes with fine scale variability where fire intensity was reduced.	• Older and larger patch sizes. • Young stands less abundant.	Large patches are common with fine scale variability.
Fire Regime = ***High Severity, Low Frequency*** *(continued)*			
Openings	Meadows are relatively common.	Meadows are common, with some encroachment by trees.	Meadows are burned where site specific analysis shows benefit to meadow species and structure.
Distribution of age classes (seral stages)	Large acreage of old stands.	Suppression of small fires results in increased stand homogeneity.	Increase proportion of young stands to decrease possibility of large scale, stand replacing fires.
Dead wood	• Snags in large patches after fires and during insect epidemics. • Small patches and individual snags abundant in middle aged and older stands. • Coarse woody debris abundant.	Snags in large patches may be more common due to epidemics.	Dead wood continues to be created in pulses after fire and disease/insect disturbance.

Issue 2: Wildlife Habitat Quantity and Quality.

	Past	Present	Desired Future Condition
All fire regimes			
Human-caused extinction rate	Not an issue	• Existing populations of TES species are found in unique and/or vulnerable habitats. • Management tool of choice is "non-disturbance."	TES populations and habitats are secure – disturbance factors and processes are not threatening to habitats and populations
Habitat Elements (HEs)	Processes such as fire created HEs (e.g., snags, large tree structure, down wood, openings) that were important to many TES species (e.g., woodpeckers, owls, bats, plant and fungus spp.).	• Fire suppression and other human modifications have interrupted processes from creating Hes • Fewer HEs are recruited and retained in the system	Processes are operating well enough to create HEs in areas where they were most lacking but had been present in the past.
Species disturbance response	• Local extinctions likely occurred on a small scale. • Linkages available to allow recolonization over time. • Gene flow dynamic.	• Fragmentation at the coarse and fine scale interrupt habitat linkages. • Local extinctions are common and spreading. • Recolonization is difficult to impossible in many areas. • Gene flow is reduced.	• Linkages are spatially and temporally restored in strategic areas. • Fire is used to create present and future linkage structure. • Recolonization of restored areas is realized. • Gene flow is improved.

	Past	Present	Desired Future Condition
Fire Regime = ***Low Severity/ High Frequency***			
Species composition	Prairie/grassland, oak woodland, and wetland associated species were favored.	• Huge alterations: fire suppression, habitat conversion, exotic invasion. • Prairie/oak associates show declining population trends (e.g., Fender's blue butterfly and Kinkaid's lupine, Acorn woodpecker, sharp-tailed snake, many plant species).	• Fire plays a role in restoring and maintaining prairie and oak habitat sites throughout the regime in sites relatively free of exotic species. • Associated TES species increase in numbers and have several populations located throughout the valley.
Fire Regime = ***Variable Severity, High Frequency***			
Species composition	Oak woodland species, open pine forest, and older open Douglas-fir forest species were favored (e.g., Lewis' woodpecker, pileated woodpecker, northern goshawk, and western gray squirrel).	• Alterations favor brushland species and denser canopy 2nd growth Douglas-fir forest associates. • Declining population trends in pine/oak and open forest associates.	• Fire plays a role in restoring and maintaining pine/oak and open Douglas-fir sites throughout the regime. • Associated TES species increase in numbers and have several populations scattered across the regime.
Fire Regime = ***Variable Severity, Moderate and Low Frequency***			
Species composition	• Older, large diameter conifer forests with a multi-layer canopy structure dominated the landscape. • Fire played a role in stand level heterogeneity at long intervals. • Associated TES species (spotted owl, marbled murrelet, tailed frog; certain vascular plants, lichens, fungi, and bryophytes) found abundant optimal habitat.	• Large areas are converted to patches of young, even-aged, homogenous Douglas-fir plantations. • Optimal habitat is isolated and limited in patch size for associated TES species.	• Fire plays a role in diversifying fine scale stand structure to recreate optimal habitat for TES species. • Patch size is increased and stands are strategically designated to provide future habitat and linkages.

	Past	Present	Desired Future Condition
Fire Regime = ***High Severity, Low Frequency***			
Species composition	• Large patches of high canopy closure, high elevation tree species with fine scale heterogeneity. • Pulses of abundant dead charred wood. • Good habitat for species such as lynx, wolverine and black-backed woodpeckers. • More frequent, low intensity fires. Fires tended to stay contained in smaller patches due to heterogeneity of stand structure.	• Fine scale heterogeneity declining – forests more homogenous. • When disturbances occur, they tend to be larger due to increased homogeneity. • As both forest age and homogeneity increases, patch size of disturbance also increases. • Habitat is still functional for TES species. • Limiting factors: human disturbance, exploitation, and alterations.	• Fire is allowed to play its ecological role. • Pulses of snags are periodically recruited into the system and allowed to remain standing as a significant component. • Low intensity fires are allowed to create stand heterogeneity. • Patch size of homogenous forest is reduced.

Issue 3: Forest Pathogens

	Past	Present	Desired Future Condition
Fire Regime = ***Low Severity/ High Frequency***			
Forest Pathogens	Pathogens endemic.	Pathogens endemic.	Pathogens endemic.
Fire Regime = ***Low Severity/ High Frequency***			
Forest Pathogens	Pathogens endemic.	Pathogens endemic.	Pathogens endemic.
Fire Regime = ***Low Severity/ High Frequency***			
Forest Pathogens	Pathogens endemic.	Pathogens endemic.	Pathogens endemic.
Fire Regime = ***Low Severity/ High Frequency***			
Forest Pathogens	Pathogens endemic.	Pathogens endemic.	Pathogens endemic.
Fire Regime = ***High Severity/ Low Frequency***			
Forest Pathogens	Pathogens endemic and possibly epidemic at intervals.	Pathogens endemic and epidemic.	• Pathogens endemic and epidemic. • Fuel hazard resulting from epidemic outbreaks are treated when they threaten life and property.

Issue 4: Natural Fuels

	Past	Present	Desired Future Condition
Fire Regime = ***Low Severity/ High Frequency***			
Fuels	Low intensity fires maintained low fuel loading and discontinuous fuels.	• Fuel loading and continuity is reduced due to roads and development. • Loading and continuity is very high in some areas, primarily on private land.	Fuels are reduced based on site-specific evaluations.
Fire Regime = ***Variable Severity/ High Frequency***			
Fuels	• Low intensity fire maintained. • Low fuel loading, and discontinuous fuels.	Fuel loading and continuity are increasing.	Fuels are reduced based on site-specific evaluations.
Fire Regime = ***Variable Severity/ Moderate Frequency***			
Fuels	Low, moderate and high severity fires contributed to widely variable amounts and distribution of fuels.	• In unmanaged stands, fuel loading and continuity are increasing. • In managed stands, roads and forest management activities interrupt fuel continuity.	• Fuel loading is widely variable in amount and distribution. • Fuels are reduced based on site-specific evaluations.
Fire Regime = ***Variable Severity/ Low Frequency***			
Fuels	Low, moderate and high severity fires contributed to widely variable amounts and distribution of fuels.	• Fuel loading and continuity are increasing in many areas. • Roads and forest management activities interrupt fuel continuity.	• Fuel loading is widely variable in amount and distribution. • Fuels are reduced based on site-specific evaluations.

	Past	Present	Desired Future Condition
Fire Regime = ***High Severity/ Low Frequency***			
Fuels	• Fuels accumulated over time and space to create large patches of similar conditions. • Fires were large, stopping at past fire event boundaries.	• Fuel accumulation continues as in the past. • Patch size of stands is increasing and results in larger fire sizes.	• Fuels are reduced based on site-specific evaluations. • Fuel treatment activities occur in areas where treatments will contribute to limiting future fire size.

Issue 5: Noxious Plants.

	Past	Present	Desired Future Condition
All fire regimes			
Noxious & Invasive Plants	Noxious and invasive plants had not been introduced.	• Noxious and invasive plants ubiquitous, especially in roaded areas and lower elevations. • Disturbances such as fire can aid the establishment of many species.	• Area occupied by noxious and invasive plants is reduced. • Prevention of dispersal and establishment of noxious and invasive plants is a feature of all activities.

Issue 6: Water Quality

	Past	Present	Desired Future Condition
Fire Regime = ***Variable Severity/ High Frequency*** *and* ***Variable Severity/ Moderate Frequency***			
Water Quality	• Fire occurred frequently and partially removed understory vegetation. • Only minimal increases in water temperatures and/or turbidity due to remaining overstory vegetation.	Fire suppression has reduced immediate effects to temperature and turbidity, but the magnitude of effects are greater when fires escape suppression.	• Reintroduce fire at historical frequencies as an element of a natural ecosystem. • Reduce other negative non-natural water quality impacts.
Stream Habitat	• Fire, landslides and floods were primary sources for the delivery of large wood and sediment to streams. • Large trees were slowly recruited into the stream channel.	• Human caused processes are delivering sediment to streams, and wood recruitment is greatly reduced. • Naturally recruited wood is smaller in size and is more easily transported off site. • Higher fire intensity due to past fire suppression consumes more instream wood.	• Allow fire to naturally thin riparian timber stands resulting in an overstory of large fire resistant trees. • Reduce non-natural sediment inputs.
Fire Regime = ***Variable Severity/ Low Frequency*** *and* ***High Severity/ Low Frequency***			
Water Quality	• Fire affected stream temperature and turbidity infrequently. • However, effects were of high magnitude, removing stream shade and ground cover and increasing water temperature and turbidity. • Effects lasted many years.	• Fire suppression has reduced the immediate effects to temperature and turbidity. • Magnitude of effects is similar (to past) when fires escape suppression. • Extent of effects is greater due to the larger fire size.	• Reintroduce fire at historical frequencies as an element of a natural ecosystem. • Reduce other negative non-natural water quality impacts.

	Past	Present	Desired Future Condition
Fire Regime = ***Variable Severity/ Low Frequency*** *and* ***High Severity/ Low Frequency*** *(continued)*			
Stream Habitat	• Fire played an important role in recruitment of wood and substrate to streams. • High mortality of overstory trees resulted in high recruitment for several years, followed by long periods of no recruitment. • Loss of ground cover resulted in increased erosion and sediment delivery to streams, providing spawning and rearing substrate.	• Fire suppression has had little effect on riparian areas. • Larger portions of watersheds may be affected due to the larger fire size. • Refugia may be limited for some species.	Consider implementing actions that would reduce overall fire size to allow some refugia to remain.
Fire Regime = ***Variable Severity/ Low Frequency*** *and* ***High Severity/ Low Frequency***			
Water Quality	• Fire frequently removed streamside vegetation, but the effects on water temperature and turbidity were minimal. • Effects were of short duration.	• Fire suppression has had little impact on water temperature and turbidity. • Some minor changes in water chemistry may be occurring. • Human caused impacts have reduced water quality, so the threshold for tolerable change has been reduced.	Limit human-caused impacts to water quality and allow fire to return.
Stream Habitat	• Fire did not play an important role in the development of stream habitat.	• Streams have been modified by development. • Fire is actively suppressed.	• Same as present.

Issue 7: Air Quality.

	Past	Present	Desired Future Condition
All fire regimes			
Wildfires	• Large fires produce high density, large scale smoke events. • Regular prescribed burning by American Indians produces smoke in the fall. • Smoke the only major pollutant.	• Large fires produce high density, large scale smoke events. • Burning of slash and grass stubble declining. • Major input of pollution from transportation and industry.	As the area of managed low intensity fires increases, the amount of smoke produced in wildfire events decreases.
All fire regimes *(continued)*			
Prescribed Fires	Smoke events occurred during most atmospheric conditions including inversions.	• Prescribed fire smoke primarily restricted to conditions where smoke is vented away from settled areas. • Increased ability to manage smoke.	• Prescribed fire smoke primarily restricted to conditions where smoke is vented away from settled areas. • Increased ability to manage smoke.

Issue 8: Social Dimensions

	Past	Present	Desired Future Condition
All fire regimes			
Fuels	• Frequent fires near settlements and along travel ways and minimal suppression of large fires. • Fuel loading kept low near settlements.	• Fires suppressed on most lands. • Small scale restoration fire, slash burning, stubble burning. • Housing encroaching on "natural" fuels, such as second growth forest (wildland/urban interface).	• Structures (e.g., houses) and improvements are mapped in high risk areas. • Partnership with local fire organizations help educate owners on "defensible space." • Recreational sites in high risk areas are identified and prioritized for treatment.
Aesthetics	Perceptions determined by culture and the utility of fire in achieving desired objectives.	• Stand replacement fire viewed as "ugly." • Partial burns and older burned areas often not recognized as fire events. • Reduced visibility from smoke viewed as negative.	• Stand replacement fires in critical view sheds and sensitive foreground areas are suppressed. • Low intensity fires are used to reduce catastrophic fire risk. • Air quality improved.
Benefit to Society	• People used fire as a tool. • Fire helped people control their environment, food supply. • Fire viewed as positive.	• Fire seen as predominantly destructive, a threat to life and property. • People do not directly benefit from fires, generally do not like the result of fire.	• Understanding the role of fire in the landscape reduces resistance to managing natural fuels with fire. • Low intensity fires are used as "living classrooms."

Issue 9: Safety

	Past	Present	Desired Future Condition
All fire regimes			
Safety	• People worked with fire regularly, the rate of injury is unknown. • Prescribed fire near settlements reduced incidence of high intensity fire.	• Workers on wildfires have high rates of injuries and fatalities. • Risk to private property is increasing.	• Use of prescribed fire and mechanical treatment reduces intensity of subsequent wildfires, reduces risk to people and property. • Limiting firefighter exposure to risk is a major component of fire management. • Use of mechanical treatment near private property reduces risk.